



SAS Superstructure

Location: 04-SF-80-13.2 / 13.9

Client Name: CalTrans

Run date 21-Nov-14

Time 12:07 AM

Daily Diary Report by Bid Item

Contract No.: 04-0120F4

Diary #: 089 Const Calendar Day: 567 Date: 29-Mar-2011 Tuesday

Inspector Name: Iranmanesh, Abbas Title: Transportation Engineer

Inspection Type:

Shift Hours: Break: Over Time:

Federal ID:

Location:

Reviewer: Boal, Brian Approved Date: 10-Oct-13 Status: Approved

04-0120F4
04-SF-80-13.2/13.9
Self-Anchored
Suspension Bridge

Weather

Temperature 7 AM 12 PM 4PM

Precipitation Condition

Working Day ☐ If no, explain:

Diary:

Dispute

Work description.

- 1- ABF had no activity today.
- 2- The anchor rods of the deviation saddles are steel ASTM Grade BC with Minimum of Ultimate Tensile strength of $F_u = 739 \text{ Mpa}$. The contract plan specifies the rods shall be pre-tensioned by jacking to 70% of their full ultimate tensile strength. A check has been done on the pre-tensioning value given in the submittal ABF-SUB-1684R01. The attached calculations show that the rods are jacked to 75% of their ultimate strength, which is more conservative due to anchor head losses. The rods are jacked by BLOLTIGHT model TDF-2000-02-00 with a Hydraulic Pressure Area of 8758 mm^2 to a pre-tension force of 1041 KN, which is equivalent to a gage pressure of 17250 psi. If any other model of BOLTIGHT with higher a Hydraulic Pressure Area is used a smaller gage pressure is required to achieve the pre-tensioning force of 1041 KN. ABF requires to declare the type of jack and calibration certification before any pre-tensioning. It is the right of Caltrans inspectors to verify the gage pressure for each anchor rod.

Attachment

Q1760

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OIL PRESSURE CALCULATION AND GRAPHS

The formula used to calculate the Oil Pressure to be used with a bolt tensioning tool are given below along with definitions of the terms used :-

Bolt Load
Residual Bolt Load required when the tensioning operation is complete

Tensioning Force
The load that will be applied by the bolt tensioner during the tensioning operation

Load Loss Allowance
The ratio of Tensioning Force to Bolt Load

Load Loss Allowance = $\frac{\text{Tensioning Force}}{\text{Bolt Load}} = 1.01 \times \frac{\text{Bolt Diameter}}{\text{Grip Length}}$

If the Load Loss Allowance calculates to less than 1.10 then use 1.10.

Tensioning Force = **Bolt Load** \times **Load Loss Allowance**

Always check that the tensioning force will not exceed 90% of the yield strength of the bolt material. If it does, the grip length of the bolt must be increased. Contact BOLTIGHT Ltd for advice on this.

Oil Pressure (bar) = $\frac{10 \times \text{Tensioning Force (Newtons)}}{\text{Tool Pressure Area (mm}^2\text{)}}$

Oil pressure graphs are provided for each bolt size.

One graph shows the theoretical tensioning force developed by the tool against the oil pressure applied.

The next graphs show the initial bolt stress developed by the tool against the oil pressure applied for each bolt size. This graph is provided to assist with the check that the tensioning force does not exceed 95% of the yield strength of the bolt material.

Users who require highly accurate residual bolt stresses should perform a bolt extension measurement before and after tensioning. In this way residual bolt stresses can be calculated from the actual bolt extensions measured.

3. EXAMPLES
1. LOAD LOSS ALLOWANCE = $1.01 \times \frac{20.000}{100.000} = 1.02$ (USE 1.10)
2. BASED ON LARGEST TENSIONING EQUIPMENT DIMENSIONS: 8.00 HORIZONTAL

4. RESULTS
LOAD LOSS ALLOWANCE = $1.01 \times \frac{10.000}{100.000} = 1.01$ (USE 1.10)
BASED ON LARGEST TENSIONING EQUIPMENT DIMENSIONS: 8.00 HORIZONTAL

TENSIONING FORCE INCLUDED IN GRIP LENGTH

Reaction: 1 Page No 6

A 354 - 07a

TABLE 9 Tensile Requirements for AB Full-Size Passengers-Feet-Pound Units

Bolt Size in.	Tensile Strength ksi	Yield Strength ksi	Standard 150		Standard 160		Standard 170		Standard 180		Standard 190		Standard 200	
			Min. Tensile Strength ksi	Min. Yield Strength ksi	Min. Tensile Strength ksi	Min. Yield Strength ksi	Min. Tensile Strength ksi	Min. Yield Strength ksi	Min. Tensile Strength ksi	Min. Yield Strength ksi	Min. Tensile Strength ksi	Min. Yield Strength ksi		
1/2	75	55	75,000	55,000	80,000	60,000	85,000	65,000	90,000	70,000	95,000	75,000	100,000	80,000
3/4	90	65	90,000	65,000	95,000	70,000	100,000	75,000	105,000	80,000	110,000	85,000	115,000	90,000
1	105	75	105,000	75,000	110,000	80,000	115,000	85,000	120,000	90,000	125,000	95,000	130,000	100,000
1 1/4	120	85	120,000	85,000	125,000	90,000	130,000	95,000	135,000	100,000	140,000	105,000	145,000	110,000
1 1/2	135	95	135,000	95,000	140,000	100,000	145,000	105,000	150,000	110,000	155,000	115,000	160,000	120,000
1 3/4	150	105	150,000	105,000	155,000	110,000	160,000	115,000	165,000	120,000	170,000	125,000	175,000	130,000
2	165	115	165,000	115,000	170,000	120,000	175,000	125,000	180,000	130,000	185,000	135,000	190,000	140,000
2 1/4	180	125	180,000	125,000	185,000	130,000	190,000	135,000	195,000	140,000	200,000	145,000	205,000	150,000
2 1/2	195	135	195,000	135,000	200,000	140,000	205,000	145,000	210,000	150,000	215,000	155,000	220,000	160,000
2 3/4	210	145	210,000	145,000	215,000	150,000	220,000	155,000	225,000	160,000	230,000	165,000	235,000	170,000
3	225	155	225,000	155,000	230,000	160,000	235,000	165,000	240,000	170,000	245,000	175,000	250,000	180,000
3 1/4	240	165	240,000	165,000	245,000	170,000	250,000	175,000	255,000	180,000	260,000	185,000	265,000	190,000
3 1/2	255	175	255,000	175,000	260,000	180,000	265,000	185,000	270,000	190,000	275,000	195,000	280,000	200,000
3 3/4	270	185	270,000	185,000	275,000	190,000	280,000	195,000	285,000	200,000	290,000	205,000	295,000	210,000
4	285	195	285,000	195,000	290,000	200,000	295,000	205,000	300,000	210,000	305,000	215,000	310,000	220,000
4 1/4	300	205	300,000	205,000	305,000	210,000	310,000	215,000	315,000	220,000	320,000	225,000	325,000	230,000
4 1/2	315	215	315,000	215,000	320,000	220,000	325,000	225,000	330,000	230,000	335,000	235,000	340,000	240,000
4 3/4	330	225	330,000	225,000	335,000	230,000	340,000	235,000	345,000	240,000	350,000	245,000	355,000	250,000
5	345	235	345,000	235,000	350,000	240,000	355,000	245,000	360,000	250,000	365,000	255,000	370,000	260,000
5 1/4	360	245	360,000	245,000	365,000	250,000	370,000	255,000	375,000	260,000	380,000	265,000	385,000	270,000
5 1/2	375	255	375,000	255,000	380,000	260,000	385,000	265,000	390,000	270,000	395,000	275,000	400,000	280,000
5 3/4	390	265	390,000	265,000	395,000	270,000	400,000	275,000	405,000	280,000	410,000	285,000	415,000	290,000
6	405	275	405,000	275,000	410,000	280,000	415,000	285,000	420,000	290,000	425,000	295,000	430,000	300,000
6 1/4	420	285	420,000	285,000	425,000	290,000	430,000	295,000	435,000	300,000	440,000	305,000	445,000	310,000
6 1/2	435	295	435,000	295,000	440,000	300,000	445,000	305,000	450,000	310,000	455,000	315,000	460,000	320,000
6 3/4	450	305	450,000	305,000	455,000	310,000	460,000	315,000	465,000	320,000	470,000	325,000	475,000	330,000
7	465	315	465,000	315,000	470,000	320,000	475,000	325,000	480,000	330,000	485,000	335,000	490,000	340,000
7 1/4	480	325	480,000	325,000	485,000	330,000	490,000	335,000	495,000	340,000	500,000	345,000	505,000	350,000
7 1/2	495	335	495,000	335,000	500,000	340,000	505,000	345,000	510,000	350,000	515,000	355,000	520,000	360,000
7 3/4	510	345	510,000	345,000	515,000	350,000	520,000	355,000	525,000	360,000	530,000	365,000	535,000	370,000
8	525	355	525,000	355,000	530,000	360,000	535,000	365,000	540,000	370,000	545,000	375,000	550,000	380,000
8 1/4	540	365	540,000	365,000	545,000	370,000	550,000	375,000	555,000	380,000	560,000	385,000	565,000	390,000
8 1/2	555	375	555,000	375,000	560,000	380,000	565,000	385,000	570,000	390,000	575,000	395,000	580,000	400,000
8 3/4	570	385	570,000	385,000	575,000	390,000	580,000	395,000	585,000	400,000	590,000	405,000	595,000	410,000
9	585	395	585,000	395,000	590,000	400,000	595,000	405,000	600,000	410,000	605,000	415,000	610,000	420,000
9 1/4	600	405	600,000	405,000	605,000	410,000	610,000	415,000	615,000	420,000	620,000	425,000	625,000	430,000
9 1/2	615	415	615,000	415,000	620,000	420,000	625,000	425,000	630,000	430,000	635,000	435,000	640,000	440,000
9 3/4	630	425	630,000	425,000	635,000	430,000	640,000	435,000	645,000	440,000	650,000	445,000	655,000	450,000
10	645	435	645,000	435,000	650,000	440,000	655,000	445,000	660,000	450,000	665,000	455,000	670,000	460,000
10 1/4	660	445	660,000	445,000	665,000	450,000	670,000	455,000	675,000	460,000	680,000	465,000	685,000	470,000
10 1/2	675	455	675,000	455,000	680,000	460,000	685,000	465,000	690,000	470,000	695,000	475,000	700,000	480,000
10 3/4	690	465	690,000	465,000	695,000	470,000	700,000	475,000	705,000	480,000	710,000	485,000	715,000	490,000
11	705	475	705,000	475,000	710,000	480,000	715,000	485,000	720,000	490,000	725,000	495,000	730,000	500,000
11 1/4	720	485	720,000	485,000	725,000	490,000	730,000	495,000	735,000	500,000	740,000	505,000	745,000	510,000
11 1/2	735	495	735,000	495,000	740,000	500,000	745,000	505,000	750,000	510,000	755,000	515,000	760,000	520,000
11 3/4	750	505	750,000	505,000	755,000	510,000	760,000	515,000	765,000	520,000	770,000	525,000	775,000	530,000
12	765	515	765,000	515,000	770,000	520,000	775,000	525,000	780,000	530,000	785,000	535,000	790,000	540,000
12 1/4	780	525	780,000	525,000	785,000	530,000	790,000	535,000	795,000	540,000	800,000	545,000	805,000	550,000
12 1/2	795	535	795,000	535,000	800,000	540,000	805,000	545,000	810,000	550,000	815,000	555,000	820,000	560,000
12 3/4	810	545	810,000	545,000	815,000	550,000	820,000	555,000	825,000	560,000	830,000	565,000	835,000	570,000
13	825	555	825,000	555,000	830,000	560,000	835,000	565,000	840,000	570,000	845,000	575,000	850,000	580,000
13 1/4	840	565	840,000	565,000	845,000	570,000	850,000	575,000	855,000	580,000	860,000	585,000	865,000	590,000
13 1/2	855	575	855,000	575,000	860,000	580,000	865,000	585,000	870,000	590,000	875,000	595,000	880,000	600,000
13 3/4	870	585	870,000	585,000	875,000	590,000	880,000	595,000	885,000	600,000	890,000	605,000	895,000	610,000
14	885	595	885,000	595,000	890,000	600,000	895,000	605,000	900,000	610,000	905,000	615,000	910,000	620,000
14 1/4	900	605	900,000	605,000	905,000	610,000	910,000	615,000	915,000	620,000	920,000	625,000	925,000	630,000
14 1/2	915	615	915,000	615,000	920,000	620,000	925,000	625,000	930,000	630,000	935,000	635,000	940,000	640,000
14 3/4	930	625	930,000	625,000	935,000	630,000	940,000	635,000	945,000	640,000	950,000	645,000	955,000	650,000
15	945	635	945,000	635,000	950,000	640,000	955,000	645,000	960,000	650,000	965,000	655,000	970,000	660,000
15 1/4	960	645	960,000	645,000	965,000	650,000	970,000	655,000	975,000	660,000	980,000	665,000	985,000	670,000
15 1/2	975	655	975,000	655,000	980,000	660,000	985,000	665,000	990,000	670,000	995,000	675,000	1,000,000	680,000
15 3/4	990	665	990,000	665,000	995,000	670,000	1,000,000	675,000	1,005,000	680,000	1,010,000	685,000	1,015,000	690,000
16	1,005	675	1,005,000	675,000	1,010,000	680,000	1,015,000	685,000	1,020,000	690,000	1,025,000	695,000	1,030,000	700,000
16 1/4	1,020	685	1,020,000	685,000	1,025,000	690,000	1,030,000	695,000	1,035,000	700,000	1,040,000	705,000	1,045,000	710,000
16 1/2	1,035	695	1,035,000	695,000	1,040,000	700,000	1,045,000	705,000	1,050,000	710,000	1,055,000	715,000	1,060,000	720,000
16 3/4	1,050	705	1,050,000	705,000	1,055,000	710,000	1,060,000	715,000	1,065,000	720,000	1,070,000	725,000	1,075,000	730,000
17	1,065	715	1,065,000	715,000	1,070,000	720,000	1,075,000	725,000	1,080,000	730,000	1,085,000	735,000	1,090,000	740,000
17 1/4	1,080	725	1,080,000	725,000	1,085,000	730,000	1,090,000	735,000	1,095,000	740,000	1,100,000	745,000	1,105,000	750,000
17 1/2	1,095	735	1,095,000	735,000	1,100,000	740,000	1,105,000	745,000	1,110,000	750,000	1,115,000	755,000	1,120,000	760,000
17 3/4	1,110	745	1,110,000	745,000	1,115,									

Daily Diary Report by Bid Item

Job Name: 04-0120F4

Inspector Name: Iranmanesh, Abbas

Diary #: 089

Date: 29-Mar-2011 Tuesday

Abbas Iranmanesh *23:55 AM*

$0.7 F_u = 0.7(795) = 556.5 \text{ MPa}$ *TDF-2000-02-03*
 $A_{50} = 2.5 \text{ in}^2 \text{ (1625.7 mm}^2\text{)}$ *Bolt Tensioning Steel*

Tension Force = Bolt Load (1.01 + $\frac{\text{Bolt Diameter}}{5 \times \text{Thread Length}}$)

Bolt Load = $0.7 F_u (A) = (556.5 \times 1625.7 \times 10^{-6}) = 0.9076 \text{ MN}$
OR 203.6 kN @ 216 kN

Tension Force = $910 (1.01 + \frac{1}{500})$
= $912 (1.02) = 933 \text{ kN}$

Oil Pressure = $\frac{10 \times \text{Tension Force (N)}}{\text{Total Pressure Area}}$

Oil Pressure = $\frac{10 \times 933 \times 10^3}{8758} = 1122.4 \text{ Bar (163380 PSI)}$

Check with $0.75 F_u = 0.75(795) = 596 \text{ MPa}$
Bolt Load = $0.75 F_u (A) = (0.75 \times 795)(1625.7 \times 10^{-6}) = 0.975 \text{ MN}$
OR 975 kN

Tension Force = $975 (1.02) = 1053 \text{ kN}$

Oil Pressure = $\frac{10 \times 1053 \times 10^3}{8758} = 1202.3 \text{ Bar (17438 PSI or 17440 PSI)}$

which is close to 12,230 PSI of the pressure load graph (submitted MBF-SUB-1024-R01).
12,230 PSI @ 100%, MBF has increased the pre-tensioning force about 6% which is more conservative due to load loss.